

We claim:

1. A cellulose mixed ester having the following properties:
  - a total degree of substitution per anhydroglucose unit of from about 3.08 to about 3.50, having the following substitutions:
    - a degree of substitution per anhydroglucose unit of hydroxyl of no more than about 0.70,
    - a degree of substitution per anhydroglucose unit of C<sub>3</sub>-C<sub>4</sub> esters from about 0.80 to about 1.40, and
    - a degree of substitution per anhydroglucose unit of acetyl of from about 1.20 to about 2.34;
    - an inherent viscosity of from about 0.05 to about 0.15 dL/g, as measured in a 60/40 (wt./wt.) solution of phenol/tetrachloroethane at 25 °C;
  - 15 a number average molecular weight (M<sub>n</sub>) of from about 1,000 to about 5,600;
  - a weight average molecular weight (M<sub>w</sub>) of from about 1,500 to about 10,000; and
  - a polydispersity of from about 1.2 to about 3.5.
- 20 2. The cellulose mixed ester according to claim 1, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in propylene glycol monomethyl ether.
- 25 3. The cellulose mixed ester according to claim 1, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in propylene glycol methyl acetate.

4. The cellulose mixed ester according to claim 1, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in diethylene glycol methyl ether.

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5. The cellulose mixed ester according to claim 1, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises propionyl.

6. The cellulose mixed ester according to claim 1, wherein the  
10 degree of substitution per anhydroglucose unit of hydroxyl is from about 0.05 to about 0.70.

7. The cellulose mixed ester according to claim 1 wherein the  
inherent viscosity is from about 0.05 to about 0.12 dL/g, as measured in a  
15 60/40 (wt./wt.) solution of phenol/tetrachloroethane at 25 °C.

8. The cellulose mixed ester according to claim 1, wherein the  
number average molecular weight (M<sub>n</sub>) is from about 1,500 to about 5,000.

20 9. The cellulose mixed ester according to claim 1, wherein the  
polydispersity is from 1.2 to 2.5.

10. The cellulose mixed ester according to claim 1, wherein the  
inherent viscosity is from 0.07 to 0.11 dL/g.

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11. The cellulose mixed ester according to claim 1, wherein the  
number average molecular weight (M<sub>n</sub>) is from about 1,000 to about 4,000.

30 12. The cellulose mixed ester according to claim 1, wherein the  
C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester

exhibits a viscosity no greater than 6,000 centipoise as a 50 wt.% solution in a 90/10 by weight mixture of n-butyl acetate/xylene.

13. The cellulose mixed ester according to claim 1, wherein the  
5  $C_3$ - $C_4$  ester comprises butyryl, and wherein the cellulose mixed ester exhibits a viscosity no greater than 3,000 centipoise as a 50 wt.% solution in a 90/10 by weight mixture of n-butyl acetate/xylene.
14. A cellulose mixed ester having the following properties:  
10 a total degree of substitution per anhydroglucose unit of from about 3.08 to about 3.50, having the following substitutions:
  - a degree of substitution per anhydroglucose unit of hydroxyl of no more than about 0.70;
  - a degree of substitution per anhydroglucose unit of  $C_3$ - $C_4$  esters from about 1.40 to about 2.45, and
  - 15 a degree of substitution per anhydroglucose unit of acetyl of from about 0.20 to about 0.80;
  - an inherent viscosity of from about 0.05 to about 0.15 dL/g, as measured in a 60/40 (wt./wt.) solution of phenol/tetrachloroethane at  
20 25 °C;
  - a number average molecular weight ( $M_n$ ) of from about 1,000 to about 5,600;
  - 25 a weight average molecular weight ( $M_w$ ) of from about 1,500 to about 10,000; and
  - a polydispersity of from about 1.2 to about 3.5.
15. The cellulose mixed ester according to claim 14, wherein the  $C_3$ - $C_4$  ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in C-11 ketone.  
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16. The cellulose mixed ester according to claim 14, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in diisobutyl ketone.

5 17. The cellulose mixed ester according to claim 14, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in propylene glycol monopropyl ether.

10 18. The cellulose mixed ester according to claim 14, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in ethylene glycol monopropyl ether.

15 19. The cellulose mixed ester according to claim 14, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in ethylene glycol monobutyl ether.

20 20. The cellulose mixed ester according to claim 14, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in methanol.

25 21. The cellulose mixed ester according to claim 14, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in ethanol with 5% water, containing methanol, methyl isobutyl ketone, and ethyl acetate as denaturants.

22. The cellulose mixed ester according to claim 14, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in toluene.

5 23. The cellulose mixed ester according to claim 14, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in a 90/10 by weight isopropyl alcohol/ water blend.

10 24. The cellulose mixed ester according to claim 14, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises propionyl.

15 25. The cellulose mixed ester according to claim 14, wherein the degree of substitution per anhydroglucose unit of hydroxyl is from about 0.05 to about 0.70.

26. The cellulose mixed ester according to claim 14, wherein the inherent viscosity is from about 0.05 to about 0.12 dL/g, as measured in a 60/40 (wt./wt.) solution of phenol/tetrachloroethane at 25 °C.

20 27. The cellulose mixed ester according to claim 14, wherein the number average molecular weight (M<sub>n</sub>) is from about 1,500 to about 5,000.

25 28. The cellulose mixed ester according to claim 14, wherein the polydispersity is from 1.2 to 2.5.

29. The cellulose mixed ester according to claim 14, wherein the inherent viscosity is from 0.07 to 0.11 dL/g.

30. The cellulose mixed ester according to claim 14, wherein the number average molecular weight ( $M_n$ ) is from about 1,000 to about 4,000.

31. The cellulose mixed ester according to claim 14, wherein the  
5  $C_3$ - $C_4$  ester comprises butyryl, and wherein the cellulose mixed ester exhibits a viscosity no greater than about 500 centipoise as a 50 wt.% solution in a 90/10 by weight mixture of n-butyl acetate/xylene.

32. A cellulose mixed ester having the following properties:  
10 a total degree of substitution per anhydroglucose unit of from about 3.08 to about 3.50, having the following substitutions:  
a degree of substitution per anhydroglucose unit of hydroxyl of no more than about 0.70;  
a degree of substitution per anhydroglucose unit of  
15  $C_3$ - $C_4$  esters from about 2.11 to about 2.91, and  
a degree of substitution per anhydroglucose unit of acetyl of from about 0.10 to about 0.50;  
an inherent viscosity of from about 0.05 to about 0.15 dL/g, as measured in a 60/40 (wt./wt.) solution of phenol/tetrachloroethane at  
20 25 °C;  
a number average molecular weight ( $M_n$ ) of from about 1,000 to about 5,600;  
a weight average molecular weight ( $M_w$ ) of from about 1,500 to about 10,000; and  
25 a polydispersity of from about 1.2 to about 3.5.

33. The cellulose mixed ester according to claim 32, wherein the  $C_3$ - $C_4$  ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in methanol.

34. The cellulose mixed ester according to claim 32, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in ethanol with 5% water, containing methanol, methyl isobutyl ketone, and ethyl acetate as  
5 denaturants.

35. The cellulose mixed ester according to claim 32, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in toluene.

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36. The cellulose mixed ester according to claim 32, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester forms a clear solution as a 10 weight percent mixture in a 90/10 (by weight) isopropyl alcohol/ water blend

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37. The cellulose mixed ester according to claim 32, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises propionyl.

38. The cellulose mixed ester according to claim 32, wherein the  
20 degree of substitution per anhydroglucose unit of hydroxyl is from about 0.05 to about 0.70.

39. The cellulose mixed ester according to claim 32, wherein the  
inherent viscosity is from about 0.05 to about 0.12 dL/g, as measured in a  
25 60/40 (wt./wt.) solution of phenol/tetrachloroethane at 25 °C.

40. The cellulose mixed ester according to claim 32, wherein the  
number average molecular weight (M<sub>n</sub>) is from about 1,500 to about 5,000.

41. The cellulose mixed ester according to claim 32, wherein the polydispersity is from 1.2 to 2.5.

42. The cellulose mixed ester according to claim 32, wherein the  
5 inherent viscosity is from 0.07 to 0.11 dL/g.

43. The cellulose mixed ester according to claim 32, wherein the number average molecular weight ( $M_n$ ) is from about 1,000 to about 4,000.

10 44. The cellulose mixed ester according to claim 32, wherein the C<sub>3</sub>-C<sub>4</sub> ester comprises butyryl, and wherein the cellulose mixed ester exhibits a viscosity no greater than about 200 centipoise as a 50 wt.% solution in a 90/10 by weight mixture of n-butyl acetate/xylene.

15 45. A coating composition, comprising:

- a) the cellulose mixed ester according to claim 1;
- b) one or more coating resins; and
- c) one or more solvents.

20 46. A coating composition, comprising:

- a) the cellulose mixed ester according to claim 14;
- b) one or more coating resins; and
- c) one or more solvents.

25 47. A coating composition, comprising:

- a) the cellulose mixed ester according to claim 32;
- b) one or more coating resins; and
- c) one or more solvents.

48. A coating composition comprising:

a) about 0.1 to about 50 weight percent, based on the total weight of (a) and (b) in the coating composition, of the cellulose ester according to claim 1;

5 b) about 50 to 99.9 weight percent, based on the total weight of (a) and (b) in the composition, of at least one resin selected from the group consisting of a polyester, a polyester-amide, a cellulose ester, an alkyd, a polyurethane, an epoxy resin, a polyamide, an acrylic, a vinyl polymer, a polyisocyanate, and a melamine; and

10 c) at least one solvent;

wherein the total weight of (a) and (b) is from about 5 to about 85 weight percent of the total weight of (a), (b), and (c).

49. The coating composition according to claim 48, further

15 comprising about 0.1 to about 15 weight percent, based on the total weight of the composition, of one or more coatings additives selected from the group consisting of leveling, rheology, and flow control agents; flattening agents; pigment wetting and dispersing agents; surfactants; ultraviolet (UV) absorbers; UV light stabilizers; tinting pigments; defoaming and antifoaming 20 agents; anti-settling, anti-sag and bodying agents; anti-skinning agents; anti-flooding and anti-floating agents; fungicides and mildewcides; corrosion inhibitors; thickening agents; or coalescing agents.

50. A coating composition, comprising:

25 a) about 0.1 to about 50 weight percent, based on the total weight of (a) and (b) in the coating composition, of the cellulose mixed ester according to claim 14;

b) about 50 to 99.9 weight percent, based on the total weight of (a) and (b) in the composition, of at least one resin selected from 30 the group consisting of a polyester, a polyester-amide, a cellulose

ester, an alkyd, a polyurethane, an epoxy resin, a polyamide, an acrylic, a vinyl polymer, a polyisocyanate, and a melamine; and  
5       c) at least one solvent;  
wherein the total weight of (a) and (b) is from about 5 to about  
5       85 weight percent of the total weight of (a), (b), and (c).

10       51. The coating composition according to claim 50, further  
comprising about 0.1 to about 15 weight percent, based on the total weight  
of the composition, of one or more coatings additives selected from the  
group consisting of leveling, rheology, and flow control agents; flattening  
agents; pigment wetting and dispersing agents; surfactants; ultraviolet (UV)  
absorbers; UV light stabilizers; tinting pigments; defoaming and antifoaming  
agents; anti-settling, anti-sag and bodying agents; anti-skinning agents;  
anti-flooding and anti-floating agents; fungicides and mildewcides; corrosion  
inhibitors; thickening agents; or coalescing agents.

15       52. The coating composition of claim 51, further comprising one or  
more fillers and/or pigments.

20       53. The coating composition of claim 51, wherein the pigment is  
comprised of aluminum or mica.

25       54. A shaped or formed article coated with the composition of  
claim 51.

30       55. A pigment dispersion, comprising:  
about 20 to about 50 weight percent by weight of a pigment;  
and  
about 50 to about 80 percent by weight of the cellulose mixed  
ester of claim 14.

56. The pigment dispersion of claim 55, wherein the pigment is comprised of alumina or mica.
- 5 57. A radiation curable coating containing the cellulose mixed ester according to claim 14.
- 10 58. A powder coating containing the cellulose mixed ester according to claim 14.
- 15 59. An ink composition containing the cellulose mixed ester according to claim 14.
60. A plastic material coated with the composition according to claim 51.
61. A metal coated with the composition according to claim 51.
- 20 62. A wood surface coated with the composition according to claim 51.
63. A paper coated with the composition according to claim 51.
- 25 64. The coating composition according to claim 45, wherein the one or more solvents includes water.
65. The coating composition according to claim 46, wherein the one or more solvents includes water.

66. The coating composition according to claim 47, wherein the one or more solvents includes water.